a short time, and is still under investigation. Like the blue tint, the radio-activity persists after drastic treatment. To me this proves that radio-activity does not merely consist in the adhesion of electrons or emanations given off by radium, to the surface of an adjacent body, but the property is one involving layers below the surface, and like the alteration of tint is probably closely connected with the intense molecular excitement the stone had experienced during its twelve months' burial in radium bromide.

A diamond that had been coloured blue by radium, and had acquired strong radio-active properties, was slowly heated to dull redness in a dark room. Just before visibility a faint phosphorescence spread over the stone. On cooling and examining the diamond, it was found that neither the colour nor the radio-activity had suffered appreciably.

The diamond is remarkable in another respect. It is extremely transparent to the Röntgen rays, whereas highly refracting glass, used in imitation diamonds, is almost perfectly opaque to the rays. I exposed for a few seconds over a photographic plate to the X-rays the large Delhi diamond of a rose-pink colour weighing 31½ carats, a black diamond weighing 23 carats, and a glass imitation of the pink diamond. On development, the impression where the diamond obscured the rays was found to be strong, showing that most rays passed through, while the glass was practically opaque. By this means imitation diamonds can readily be distinguished from true gems.

I have already signified that there are various degrees of refractoriness to chemical reagents among the different forms of graphite. Some dissolve in strong nitric acid; other forms of graphite require a mixture of highly concentrated nitric acid and potassium chlorate to attack them, and even with this intensely powerful agent some graphites resist longer than others. M. Moissan has shown that the power of resistance to nitric acid and potassium chlorate is in proportion to the temperature at which the graphite was formed, and with tolerable certainty we can estimate this temperature by the resistance of the specimen of graphite to this reagent.

The superficial dark coating on a diamond after exposure to molecular bombardment I have proved to be graphite.[1] M. Moissan[2] has shown that this graphite, on account of its great resistance to oxidising reagents, cannot have been formed at a lower temperature than 3600° C.

It is thus manifest that the bombarding electrons endowed with an electric charge, and striking the diamond with enormous velocity, raise the superficial layer to the temperature of the electric arc, and turn it into graphite, whilst the mass of diamond and its conductivity to heat are sufficient to keep down the general temperature to such a point that the tube appears scarcely more than warm to the touch.

A similar action occurs with silver, the superficial layers of which can be raised to a red heat without the whole mass becoming more than warm.[3]

I will now direct your attention to a strange property of the diamond, which at first sight might seem to discount the great permanence and unalterability of this stone. It has been ascertained that the cause of phosphorescence is in some way connected with the hammering of the electrons, violently driven from the negative pole, on to the surface of the body under examination, and so great is the energy of the bombardment that impinging on a piece of platinum or even iridium the metal will actually melt. When the diamond is thus bombarded in a radiant matter tube the result is startling. It not only phosphoresces, but assumes a brown colour, and when the action is long-continued becomes almost black.

I will project a diamond on the screen and bombard it with radiant matter before your eyes. I do not like to anticipate a failure, but I am at the mercy of my diamond. I cannot rehearse this experiment, and it may happen that the diamond I have selected will show caprice and not blacken in reasonable time. Some diamonds visibly darken in a few minutes, while others, more leisurely in their ways, require an hour.

This blackening is only superficial, but no ordinary means of cleaning will remove the discoloration. Ordinary oxidising reagents have little or no effect in restoring the colour. The black stain on the diamond is due to a form of graphite which is resistant to oxidation.

Conversion of Diamond into Graphite.

Although we cannot convert graphite into diamond, we can change the diamond into graphite. I take a clear crystal of diamond and place it between two carbon poles, and throw the image on the screen by means of a powerful arc lamp behind. I now bring the poles with intervening diamond together and form an arc between. The temperature of the diamond rapidly rises, and when it approaches 3600° C., the vaporising point of carbon, it breaks down, swells, and changes into black and valueless graphite. I show this experiment because it is striking and suggestive. I may add that it is costly—because the stone, if not of fine quality, might easily burst.

[1] *Chemical News*, vol. lxxiv., p. 39, July, 1896.
[2] *Comptes rendus*, cxxiv., p. 653.
[3] *Proc. Roy. Soc.*, vol. l., p. 99, June, 1891.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

SIR CLEMENTS R. MARKHAM, K.C.B., F.R.S., will deliver an address at Cambridge on Thursday, October 19, introductory to the courses of instruction in geography.

Science announces the death of General Isaac J. Wistar, of Philadelphia, founder of the Wistar Institute of Anatomy and Biology of the University of Pennsylvania, formerly president of the American Philosophical Society. By his will the Wistar Institute will receive the residue of his estate, thought to amount to about 80,000*l*.

IN the course of an address to the students of Cornell University in 1903, President Schurman emphasised the necessity of a systematic distribution of the daily time of college students. He recommended the following general apportionment of hours:—for work, eleven; for sleep, eight; for amusement, one; for meals and athletics, two hours each. Work is made to include not only time spent in the laboratory and lecture-room and in private study, but also time given to societies and to self-support. This advice led Dr. Guy M. Whipple, of Cornell University, to try to ascertain how the students in his university actually do distribute their daily time. The results of his inquiries are described in an article in the current number of the *Popular Science Monthly*. In the summary to the detailed tables given in his article Dr. Whipple states that, taking the university as a whole, the average Cornell student devotes just nine hours daily to college work, sleeps 7·9 hours, devotes 2·23 hours to amusement, 1·72 hours to physical exercise, 1·4 hours to meals, 0·39 hour to self-support, and 1·36 hours to unclassified activities. The average length of time given to work is greatest in the college of medicine, and progressively less in those of engineering, law, agriculture, and arts. Both in the university at large and within the College of Arts and Sciences, men give more time to college work than women.

PROF. J. W. JUDD, F.R.S., distributed on October 5 the medals and prizes gained during the past session by the students of the Royal College of Science, London, in the lecture theatre of the Victoria and Albert Museum, South Kensington. The Dean, Prof. Tilden, F.R.S., in opening the proceedings, referred with regret to several losses which the college and school had sustained during the year, alluding particularly to the death of Prof. Howes. The geological division had lost its chief by the retirement of Prof. Judd. The college is now, the Dean continued, in an attitude of expectancy in regard to the future, and it is possible that next year they will be able to hold the prize distribution in the new buildings. He said that in ten years seventy-six of the students of the college have taken the degree of B.Sc., and, in addition, thirty have taken first-class honours, besides which there are nine doctors of science. Prof. Judd, having distributed the awards, addressed the students. He acknowledged the uniform courtesy and consideration which he had received from colleagues and students alike during his forty-five years' experience in connection with the school. Nearly two-thirds of that period had been spent in the position of one of the teachers. He congratulated them on the expansion and development which is now promised, and expressed the hope that the change would lead to even

greater successes in the future than have been attained in the past. Mr. R. L. Morant, permanent secretary of the Board of Education, in moving a vote of thanks to Prof. Judd, said the college stood for the essential necessity of practical work as a proper means of the study of science.

THE new College of Hygiene and Physical Training instituted by the Carnegie Dunfermline trustees, which was described in our issue for September 28 (p. 550), was opened formally on October 4 by Lord Linlithgow, Secretary for Scotland and vice-president of the Council of Education in Scotland. The chairman, Dr. John Ross, delivered the opening address. He said the work of the college is to be two-fold. Following the method established for the training of the teachers in elementary schools, there is provided first what may be called a great practising school with 4500 pupils, consisting of all the school children, and next there is the college proper, consisting of young women prepared to adopt the teaching of physical culture as a profession, or to acquire for their own personal benefit a knowledge of themselves and the most rational rules of life. As yet only young women are to be received, but it is anticipated that it will be possible in the near future to receive young men. Lord Linlithgow, during the course of an interesting speech, said there is no doubt that the country is waking up to the necessity of some sort of physical training for young people, and to the necessity of a better understanding of the laws of hygiene. It is well that the public should understand what physical training means. Lord Linlithgow defined it as the careful development of the general health to the advantage of the whole body, and indirectly to the advantage of the mind. The Carnegie trustees are, he continued, doing a great and valuable service to Scotland in taking up this subject. They are doing a work which no school board can do, for it is doubtful whether public opinion has as yet ripened sufficiently to allow the Education Department to apply any considerable portion of the national funds to a purpose of this kind. It will come in time, for the public is taking an increasing interest in all that concerns the feeding, the management, the cleanliness, and physical welfare of the young generation. It is being recognised more and more that the amount of information, or book-learning, which a child acquires at school is a matter of comparatively little importance. What is wanted is the healthy training of the boy or girl both physically and mentally.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, July 14.—"The Phagocytosis of Red Blood-cells." By Dr. J. O. Wakelin **Barratt**. Communicated by Sir Victor Horsley, F.R.S.

The author has investigated the conditions under which phagocytosis of red blood-cells, by means of leucocytes, is brought about. Metchnikoff, who studied this process, attached great importance to the part played by the leucocytes, but Sawtchenko discovered that the chief factor in the production of this form of phagocytosis is sensibilisation of the red blood-cells, which can be brought about by the serum of animals which have been previously injected with the variety of red blood-cells employed for phagocytosis, and he attributed the action of the serum to the presence of amboceptor (immunisine, fixateur). That this is not so, however, is shown by the circumstance that, in the absence of amboceptor, strongly marked phagocytosis may be brought about by serum, and further experiments showed that the effective constituent is an opsonin. In addition, it was found that erythrocytic opsonins are sometimes present, usually in relatively small quantities, in normal sera, and in suitably chosen conditions of experiment may be used to prepare red blood-cells for ingestion by leucocytes.

PARIS.

Academy of Sciences, October 2.—M. Troost in the chair.—Summary of the observations of the solar eclipse of August 29–30 made at Sfax, Tunis: G. **Bigourdan**. Light clouds were present during the eclipse, but were not sufficiently numerous to interfere seriously with the observations. Particulars are given of the determination of time, the observations of the contacts, the photography of the inner corona, the monochromatic photography of the corona, the work done with the spectrographs, ocular and photographic photometry, the influence of the passage of the shadow on the magnetic state of the earth, meteorology and actinometry, drawings made with the naked eye, observation of the moving shadows, the darkness during the eclipse, and the visibility of the stars.—On the laws of sliding friction: Paul **Painlevé**. An extension of the results obtained in a previous paper and a reply to some objections.—Observation of the eclipse of the sun of August 30 at the Observatory of Marseilles: M. **Stéphan**. The atmospheric conditions were quite satisfactory. The times of first and second contact are given, and the changes of temperature were automatically registered.—On some differential equations of the second order: Richard **Fuchs**.—On minimum surfaces: S. **Bernstein**.—Experimental verifications of the undulatory form of the photographic function: Adrien **Guébhard**.—On isostrychnine: A. **Bacovesco**. Isostrychnine is obtained hy heating strychnine with water in sealed tubes at 160° C. to 180° C. The colour reactions of the isomer resemble those of the original alkaloid, but there are points of difference. The poisonous properties of the isomer are less marked than in strychnine, and, indeed, rather approximate to those of curare. That the two alkaloids are structurally different is shown by the action of sodium ethylate, which converts isostrychnine integrally into the isostrychnic acid of Tafel.—On the mode of propagation of some aquatic plants: Louis **François**.—On the geology of the Sahara: R. **Chudeau**.—On the direction of the permanent magnetisation of a metamorphic clay from Pontfarlin (Cantal): Bernard **Brunhes**.

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